COMPOSITIONS AND METHODS FOR THE DELIVERY OF THERAPEUTIC BIOLOGICS FOR TREATMENT OF DISEASE

RELATED APPLICATIONS

[0001] This application is a continuation of International Application No. PCT/US2020/050508, filed Sep. 11, 2020, published in English, which claims the benefit of U.S. Provisional Application No. 63/024,703, filed on May 14, 2020, U.S. Provisional Application No. 62/899,907, filed on Sep. 13, 2019, and U.S. Provisional Application No. 62/899,981, filed on Sep. 13, 2019. The entire teachings of the above applications are incorporated herein by reference.

GOVERNMENT SUPPORT

[0002] This invention was made with government support under Grant No. 1831212 awarded by the National Science Foundation. The government has certain rights in the invention.

TECHNICAL FIELD

[0003] The present disclosure relates to methods and compositions that enable the delivery (e.g., subcutaneous delivery) of biopharmaceutical products for therapy. In particular, the delivery method disclosed herein uses high concentration, low volume and low viscosity compositions of biologics that allow a practical transition from intravenous delivery to subcutaneous delivery of therapeutics, and permit a practical transition from frequent to less frequent subcutaneous delivery.

BACKGROUND

[0004] Biologics, particularly antibodies, have driven a paradigm shift in the course of drug discovery and development over the last few decades, assisting patients for whom few or no treatment options have previously existed. For example, current monoclonal antibody (mAb) therapies often require large doses which are administered by intravenous (IV) infusion at high-volume and low-concentration, which can take hours to deliver, causing patient discomfort and increasing the risk of infection. Subcutaneous (SC) injection provides a more desirable alternative for delivery since it decreases the burden on hospital and clinical facilities, requiring less time and lowers the risk of complications. However, SC injections require low delivery volumes which necessitate high therapeutic biologic concentrations that are often difficult to obtain. The requirement of high concentrations at low delivery volumes would also result in highly viscous injection solutions which could lead to excessively high injection forces. Moreover, a highly viscous injection solution of therapeutic biologic, e.g, mAb, would lead to increased protein-protein interactions resulting in product loss and also affects product safety. Therefore, a highly concentrated, low volume, low viscosity injection capability for SC delivery of therapeutic biopharmaceutical products is needed.

SUMMARY

[0005] Provided herein are methods useful for treating a disease or condition in a subject in need thereof, comprising administering to the subject a pharmaceutically effective amount of a composition comprising:

[0006] a plurality of particles suspended in a low viscosity pharmaceutically acceptable liquid carrier, each particle comprising at least one therapeutic biologic or a salt thereof;

[0007] wherein the particles have less than about 10% aggregation of the therapeutic biologic or salt thereof; and

[0008] the concentration of the therapeutic biologic or salt thereof in the composition is about 20 mg/mL to about 700 mg/mL.

[0009] In one aspect, the disclosure provides a method of treating cancer in a subject in need thereof, comprising administering to the subject a pharmaceutically effective amount of a composition comprising:

[0010] a plurality of particles suspended in a low viscosity pharmaceutically acceptable liquid carrier, each particle comprising at least one therapeutic biologic or a salt thereof; wherein

[0011] the particles have less than about 10% aggregation of the therapeutic biologic or salt thereof; and

[0012] the concentration of the therapeutic biologic or salt thereof in the composition is about 20 mg/mL to about 700 mg/mL.

[0013] The present disclosure also provides herein a method of treating an inflammatory disease or condition in a subject in need thereof, comprising administering to the subject a pharmaceutically effective amount of a composition comprising:

[0014] a plurality of particles suspended in a low viscosity pharmaceutically acceptable liquid carrier, each particle comprising at least one therapeutic biologic or a salt thereof; wherein

[0015] the particles have less than about 10% aggregation of the therapeutic biologic or salt thereof; and

[0016] the concentration of the therapeutic biologic or salt thereof in the composition is about 20 mg/mL to about 700 mg/mL.

[0017] In another aspect, the disclosure provides a method of treating immune disease in a subject in need thereof, comprising administering to the subject a pharmaceutically effective amount of a composition comprising:

[0018] a plurality of particles suspended in a low viscosity pharmaceutically acceptable liquid carrier, each particle comprising at least one therapeutic biologic or a salt thereof; wherein

[0019] the particles have less than about 10% aggregation of the therapeutic biologic or salt thereof; and

[0020] the concentration of the therapeutic biologic or salt thereof in the composition is about 20 mg/mL to about 700 mg/mL.

[0021] The present disclosure further provides herein a method of treating renal disease in a subject in need thereof, comprising administering to the subject a pharmaceutically effective amount of a composition comprising:

[0022] a plurality of particles suspended in a low viscosity pharmaceutically acceptable liquid carrier, each particle comprising at least one therapeutic biologic or a salt thereof; wherein

[0023] the particles have less than about 10% aggregation of the therapeutic biologic or salt thereof; and

[0024] the concentration of the therapeutic biologic or salt thereof in the composition is about 20 mg/mL to about 700 mg/mL.